116. A configurable aperiodic grating device comprising:

a plurality of grating elements having a characteristic attribute, said grating elements being arranged so as to produce an actual first spectral response of the aperiodic grating device that matches a desired first spectral response; and

a plurality of actuating elements formed on said aperiodic grating device that generates the first spectral response, said plurality of actuating elements capable of altering the actual first spectral response to produce at least one second actual spectral response that matches a desired second spectral response.

117. The grating device of claim 116, wherein the characteristic attribute is a physical dimension of a grating element.

118. The grating device of claim 117, wherein the physical dimension is at least one of a width and a height of the grating element.

119. The grating device of claim 116, wherein the characteristic attribute is a refractive index.

120. The grating device of claim 118, wherein the characteristic attribute is a spacing between adjacent grating elements.

121. The grating device of claim 116, wherein the actuating elements comprise electric contacts.

122. The grating device of claim 121, wherein the electric contacts are configured so as to receive an identical electric potential.

123. The grating device of claim 121, wherein the electric contacts are configured so as to receive a different electric potential.

124. The grating device of claim 116, wherein the actuating elements comprise heating elements.

125. Method of producing a configurable aperiodic grating device having a plurality of grating elements, comprising:

defining a cost function representing a goodness of fit between a desired spectral response and an actual spectral response of the grating device;

defining a desired first spectral response of the grating device;

assigning to each grating element of the grating device at least one characteristic attribute;

generating an initial arrangement of the grating elements;

iteratively modifying at least one characteristic attribute of at least one of the grating elements and computing for each iteration a first cost function;

if the computed first cost function for an iteration is less than a first predetermined value, selecting a corresponding arrangement of the grating elements as an optimal arrangement of the grating elements;

defining a desired second spectral response of the optimal arrangement of the grating elements;

iteratively selecting different ones of the optimally arranged grating elements and modifying a refractive index of the selected grating elements;

computing a second cost function for each arrangement of the selected grating elements having the modified refractive index; and

if the computed second cost function for an iteration is less than a second predetermined value, selecting a corresponding arrangement of the selected grating elements as an optimal arrangement of the selected grating elements to provide said second spectral response.

126. The method of claim 125, wherein assigning a characteristic attribute includes assigning at least one of a width, a height, and a refractive index of the grating element, and a spacing between adjacent grating elements.

127. The method of claim 125, wherein the initial arrangement of selected grating elements comprises a random arrangement of grating elements.

128. The method of claim 125, wherein determining an actual spectral response of the grating device includes forming a Fourier transform of the physical arrangement of the grating elements.

129. The method of claim 125, wherein inducing changes of the refractive index of the selected grating elements includes disposing electrodes on the grating device and applying an electric potential to the electrodes disposed on the selected grating elements.

Cont B2

130. The method of claim 129, wherein the applied electrical potential is identical for all electrodes.

131. The method of claim 129, wherein the applied electrical potential is different between at least some of the electrodes.

132. The method of claim 129, wherein the applied electrical potential is a binary potential.

133. The method of claim 129, wherein the applied electrical potential is a multi-level potential.

134. The method of claim 125, wherein inducing changes of the refractive index of the selected grating elements includes applying thermal energy to the selected grating elements.

135. Optical waveguide device comprising:

a waveguide layer adapted to propagate electromagnetic radiation; and

a configurable aperiodic grating device disposed on said optical waveguide layer so as to interact with radiation propagating in the optical waveguide, said aperiodic grating device comprising:

a plurality of grating elements having a characteristic attribute, said grating elements being arranged so as to produce an actual first spectral response of the aperiodic grating device that matches a desired first spectral response; and

a plurality of actuating elements formed on said aperiodic grating device that generates the first spectral response, said plurality of actuating elements capable of altering the actual first spectral response to produce at least one second actual spectral response that matches a desired second spectral response.

136. The optical waveguide device of claim 135, wherein the characteristic attribute is a physical dimension of a grating element.

137. The optical waveguide device of claim 135, wherein the physical dimension is at least one of a width and a height of the grating element.

138. The optical waveguide device of claim 135, wherein the characteristic attribute is a refractive index.

139. The optical waveguide device of claim 135, wherein the characteristic attribute is a spacing between adjacent grating elements.

140. The optical waveguide device of claim 135, wherein the actuating elements comprise electric contacts.

141. The optical waveguide device of claim 140, wherein the electric contacts are configured so as to receive an identical electric potential.

142. The optical waveguide device of claim 140, wherein the electric contacts are configured so as to receive a different electric potential.